

STABPROOF AND BULLETPROOF PANEL

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates generally to stabproof and bulletproof jackets. In particular, the present invention relates to a stabproof and bulletproof panel, which is constructed in such a way that a plurality of stabproof panels 10 for protecting the body of a user from bladed weapons, such as a knife, a machete, a stiletto and switch-blade, are attached to the front surface of a bulletproof panel for protecting the body from the bullets of firearms, such as a pistol and a rifle, thereby allowing the panel to have both stabproof and 15 bulletproof functions.

Description of the Prior Art

In general, a bulletproof jacket for protecting the body from bullets is basically comprised of a garment, a 20 bulletproof panel, and a panel covering. In general, a stabproof jacket is basically comprised of a garment, a stabproof panel, and a plate covering. The bulletproof panel, which is the principal element of a bulletproof jacket, is generally manufactured in conformity with a standard (NIJ 25 STANDARD-0101.03) for testing bulletproof jackets established

by the National Institute of Justice (NIJ), U.S. Department of Justice. It is generally tested by a test organization affiliated with the NIJ, such as H.P. White Laboratory Inc. to determine whether a bulletproof panel has been manufactured in conformity with these standards or not.

A variety of stabproof jackets and a variety of stonproof jackets are manufactured to protect the body from bladed weapons, such as a knife, a machete, a stiletto and switch-blade. Korean Utility Model Publication No. 91-5180 discloses a stonproof vest, in which many folds of carbon fiber cloths are interposed between outer and inner covers, and a protective panel formed by bonding two protective fabrics 10 to the upper and lower surfaces of a rubber plate 11 or fiber reinforced plastic plate is inserted into a space between each neighboring carbon fiber cloths. This stonproof vest is easily manufactured, is easily bent, and allows a wearer to be moved. However, this stonproof vest causes the movement of the body to be inconvenient owing to the weight of rubber plates, and this inconvenience is increased owing to the weight of protective fabrics attached to the rubber plates. Korean Utility Model Unexamined Publication No. 91-009505, as shown in Fig. 2, discloses a protective vest, in which a vest body "A" having neck and arm openings 23 and 24 and reinforcing strips 25 is formed by two protective plates 21 and 22, a woven stretch fabric is attached to the lower end

27. 18. attach to the return  
ducts, prevent leakage  
between and the ducts since airways

19. 10. 1923. - *Accordia* sp. nov. (fig. 12).

1922-1923. 1923-1924. 1924-1925. 1925-1926. 1926-1927. 1927-1928. 1928-1929.

we soon got there. The way from village to village was good from a distance, the other being a bulletproof

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from a firearm, but cannot protect the body from the sharp-edged blade of a bladed weapon and. However, there is not disclosed a stabproof and bulletproof jacket for both protecting the body from both the sharp-edged blade of a 5 bladed weapon and bullets rapidly projected from a firearm. Accordingly, one of the stabproof jacket and the bulletproof jacket is utilized separately from the other in accordance with circumstances or purposes. As a result, when a firearm and a bladed weapon are simultaneously used, its user is 10 jeopardized while performing his duty.

In order to solve the problems, the assignee of the present patent application filed Korean Pat. Appln. No. 1999-0007174. This patent application discloses a bulletproof panel for bulletproof jackets, which is manufactured in 15 conformity with a standard (NIJ STANDARD-0101.03) for testing bulletproof jackets established by the NIJ, U.S. Department of Justice which is certified by a test organization affiliated with the NIJ, such as H.P. White Laboratory Inc. as shown in table 1. As shown in Fig. 4, the assignee of the present 20 patent application discloses a bulletproof panel for bulletproof jackets, which is comprised of a front plate 45, a plurality of high density polyethylene films 44 stacked with one on top of another for dispersing impact energy, and a rear plate 46 formed by sewing together a plurality of aromatic 25 polyamide woven fabrics 46 for minimizing frictional heat and

deformation, the front plate 45 consisting of a plurality of aromatic polyamide woven fabrics 41, a felt 50 formed by forcibly inserting thin aromatic polyamide fibers or high density polyethylene fibers 52 and a shock-absorbing member 51  
5 into a scrim woven in the form of a net using aromatic polyamide fibers or high density polyethylene yarn, and a plurality of aromatic polyamide woven fabrics 43.

TABLE 1

	Aromatic polyamide woven fabric (100%)	High-density polyethylene (100%)	Previously filed bulletproof panel of assignee
NIJ standard	III A	III A	III A
Field of use and certification	-police - H.P. White Laboratory Inc. test, NIJ	-special force -recommendation of DMS Co. (manufacturer of law materials) -self test of special force	-police, special force - H.P. White Laboratory Inc. test, NIJ
Manufacturing method	Dupont Co. A363F 36 folds (for police standard)	DSM Co. SB2 34 folds (for special force)	Self-development 25 folds (for police and special force)
	A363F 1. mass: 208g/m <sup>2</sup> 2. density: 28 x 28 (fly/inch)	SB2 1. mass: 160g/m <sup>2</sup> 2. density: film	PARA-ARAMID 1. mass: 220g/m <sup>2</sup> 2. density: 30 x 30 (fly/inch) SB2: 160g/m <sup>2</sup> PARA-ARAMID

Mass (Kg/m <sup>2</sup> )	36 folds x 208 g/m <sup>2</sup> = 7.49	34 folds x 160 g/m <sup>2</sup> = 5.44	Felt: 613g/m <sup>2</sup> (1 fold) 12 folds x 220 g/m <sup>2</sup> = 2.62 12 folds x 160 g/m <sup>2</sup> = 1.92 1 fold x 613 g/m <sup>2</sup> = 0.61 5.17
	7.49/5.17 x 100 = 144.9%, about 45% heavier than previously filed panel	5.44/5.17 x 100 = 105.2%, about 5% heavier than previously filed panel	100% (reference), lightest previously filed panel is thinnest
Weight			
Thickness			
Feeling of comfort on wearing		good feeling of wearing because previously filed panel is thinnest and softest	
Cost	average	somewhat expensive	inexpensive

However, the prior art bulletproof panel filed with Korea Industrial Property Office by the assignee of the present patent application is capable of protecting the body from bullets, but cannot protect the body from a sword or spear  
5 having a sharp end.

In general, a stabproof jacket is basically comprised of a garment, a stabproof panel, and a panel covering. The stabproof panel, which is the principal element of the stabproof jacket, is generally manufactured in conformity with  
10 a standard (NIJ STANDARD-0115.00) for testing bulletproof jackets established by the NIJ, U.S. Department of Justice. It is generally tested by a test organization affiliated with

the NIJ, such as H.P. White Laboratory Inc. to determine whether the bulletproof panel has been manufactured in conformity with these standards or not.

For reference, NIJ STANDARD-0115.00 is explained in the following description. Stabproof jackets covered by this standard are classified into one of two distinct protection classes depending upon the type of threat environment. Within each threat protection class, the jacket is further classified into one of three protection levels. The levels of protection indicate the stab energy the vest is expected to satisfactorily handle. The classification of a jacket panel that provides two or more levels of protection at different locations on the panel shall be that of the minimum protection provided at any location on the panel.

15       Level 1 stabproof jacket: a low-level protection jacket suitable for extended wear and generally concealable

Level 2 stabproof jacket: a general duty garment suitable for extended wear

20       Level 3 stabproof jacket: a high-level protection jacket suitable for wear in high risk situations

The stabproof jacket should afford protection against injury from penetration by knives, edged weapons, and sharp-pointed weapons while ensuring that the movement of the wearer is not unduly restricted.

25       There are two protection classes defined in this

standard. One is intended to deal with threats that might be expected on the street from high quality. Commercially machined edged knife blades. This class is referred to as the "Edged Blade" class. The other protection class is intended 5 to deal with threats that might be expected in a corrections environment. Lower quality knife blades and spike style weapons that have been improvised from other materials typically characterize these threats. This class is referred to as the "Spike" class.

10 The three levels of protection presented in this standard were derived from a 1997-1999 PSDB program where the frequency distribution of the energy that can be delivered by a male population using several stabbing techniques was characterized. The lowest energy level corresponds of the 15 85%, the next energy level corresponds to the 90%, and the highest energy level corresponds to the 96%.

For any given protection level, the test protocol requires the knife blade or spike to impact the test sample at two distinct energy levels. The first energy level, called 20 "E1," corresponds to the percentages described above. At this condition, a maximum blade or spike penetration of 7 mm is allowable. The penetration limit was determined through research indicating that internal injuries to organs would be extremely unlikely at 7 mm of penetration. The test protocol 25 then requires an overtest condition where the knife blade or

spike kinetic energy is increased by 50%. At this higher energy condition, called "E2", a maximum blade or spike penetration of 20 mm is allowable. This overtest is required to ensure that there is an adequate margin of safety in the 5 stabproof jacket design.

TABLE 2

Protection level	"E 1" Strike Energy (ft-lbf)	"E 2" Overtest Strike Energy (ft-lbf)
1	17.7 ± 0.36	26.6 ± 0.44
2	24.3 ± 0.44	36.9 ± 0.51
3	31.7 ± 0.44	47.9 ± 0.59

In the design of the bulletproof panel and the stabproof 10 panel, protection capability against a bullet or blade should be superior, and the deformation of a panel should be considered to prevent the rearward deformation of the panel from damaging a user. Additionally, the panels should fulfill 15 various requirements that the panels should be lightweight, give a feeling of comfort on wearing to a wearer and be inexpensive.

#### SUMMARY OF THE INVENTION

20 Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an

object of the present invention is to provide a bulletproof and stabproof panel, in which a plurality of stabproof panels are attached to the front surface of a bulletproof panel, thereby protecting the body from both bullets and swords.

5 In order to accomplish the above object, the present invention provides a stabproof and bulletproof panel, comprising: a bulletproof panel comprised of a front plate consisting of a plurality of aromatic polyamide woven fabrics, a felt formed by forcibly inserting thin aromatic polyamide  
10 fibers or high density polyethylene fibers and a shock-absorbing member into a scrim woven in the form of a net using aromatic polyamide fibers or high density polyethylene yarn, and a plurality of aromatic polyamide woven fabrics, a plurality of high density polyethylene films stacked with one  
15 on top of another for dispersing impact energy, and a rear plate formed by sewing together a plurality of aromatic polyamide woven fabrics for minimizing frictional heat and deformation; and five to twelve stabproof panels brought into tight contact with the front surface of the bulletproof panel.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly  
25 understood from the following detailed description taken in

conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing a conventional stabproof panel;

Fig. 2 is a perspective view showing a conventional 5 stabproof jacket and stabproof pieces thereof;

Fig. 3 is a diagram showing a process in which a bullet is stopped by a bulletproof panel while the impact of the bullet is absorbed by the bulletproof panel;

Fig. 4 is a sectional view showing the stack structure of 10 a bulletproof panel;

Fig. 5 is a perspective view showing a felt constituting an element of the bulletproof panel of Fig. 4;

Fig. 6 is a longitudinal sectional view showing a stabproof panel of the present invention;

Fig. 7 is a view showing the deformation of a plurality 15 of tightly overlapped stabproof panels when a blade pierces the stabproof panels;

Fig. 8 is a view showing the stack of a stabproof and bulletproof panel in which a plurality of stabproof panels are 20 attached to the front surface of a bulletproof panel; and

Fig. 9 is a front view showing a stabproof and bulletproof jacket in which the stabproof and bulletproof panel enclosed in a panel covering is inserted into a panel pocket in a garment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference now should be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

As shown in Figs. 4 and 8, a stabproof and bulletproof panel in accordance with the present invention is comprised of a bulletproof panel 40 and a plurality of stabproof panels 60. The bulletproof panel 40 is comprised of a front plate 45, a plurality of high density polyethylene films 44 stacked with one on top of another for dispersing impact energy, and a rear plate 46 formed by sewing together a plurality of aromatic polyamide woven fabrics for minimizing frictional heat and deformation. The front plate 45 consists of a plurality of aromatic polyamide woven fabrics 41, a felt 50 formed by forcibly inserting thin aromatic polyamide fibers or high density polyethylene fibers 52 and a shock-absorbing member 51 into a scrim woven in the form of a net using aromatic polyamide fibers or high density polyethylene yarn, and a plurality of aromatic polyamide woven fabrics 43. The stabproof panels 60 are brought into tight contact with the front surface of the bulletproof panel 40.

A preferred embodiment of the present invention is described in detail with reference to Figs. 3 to 9.

Fig. 3 is a diagram showing a process in which a bullet

is stopped by a bulletproof panel while the impact of the bullet is absorbed by the bulletproof panel. Fig. 4 is a sectional view showing the stack structure of a bulletproof panel. Fig. 5 is a perspective view showing a felt 5 constituting an element of the bulletproof panel of Fig. 4. Fig. 6 is a longitudinal sectional view showing a stabproof panel of the present invention. Fig. 7 is a view showing the deformation of a plurality of overlapped stabproof panels when a blade pierces the stabproof panels. Fig. 8 is a view 10 showing the stack of a stabproof and bulletproof panel in which a plurality of stabproof panels are attached to the front surface of a bulletproof panel. Fig. 9 is a front view showing a stabproof and bulletproof jacket in which the stabproof and bulletproof panel enclosed in a panel covering 15 is inserted into a panel pocket in a garment.

Of the drawings, Fig. 3 is a diagram showing a process in which a bullet is stopped by a bulletproof panel while the impact of the bullet is absorbed by the bulletproof panel. When a bullet 30 fired from a rifle and heated by friction 20 with air reaches a bulletproof panel 31, the advance of the bullet 30 is restricted by the bulletproof panel 31 and the bullet 30 is gradually flattened as shown in the drawing, thereby halting the advance of the bullet 30. Accordingly, the bulletproof panel 31 should absorb impact energy 25 efficiently, bear up against a high temperature, and have

sufficient tensile strength to minimize its deformation and, thereby, prevent the body from being damaged by the deformation of the bulletproof panel 31.

Figs. 4 and 5 are views showing a bulletproof panel 5 previously filed with Korea Industrial Property Office by the assignee of the present patent application. The bulletproof panel is comprised of a front plate 45, a plurality of high density polyethylene films 44 stacked with one on top of another for dispersing impact energy, and a rear plate 46 10 formed by sewing together a plurality of aromatic polyamide woven fabrics for minimizing frictional heat and deformation. The front plate 45 consists of a plurality of aromatic polyamide woven fabrics 41, a felt 50 formed by forcibly inserting thin aromatic polyamide fibers or high density 15 polyethylene fibers 52 and a shock-absorbing member 51 into a scrim woven in the form of a net using aromatic polyamide fibers or high density polyethylene yarn, and a plurality of aromatic polyamide woven fabrics 43.

The characteristics of the felt 50 are shown in table 3.

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TABLE 3

	Aromatic polyamide	High density polyethylene	Present invention
Weight	600 g/m <sup>2</sup> or more	400 g/m <sup>2</sup> or more	400 to 600 g/m <sup>2</sup> or more
Thickness	3 mm or more	3 mm or more	3 to 3.5 mm
Tensile	280 Kg or more	350 Kg or more	280 to 350 Kg

strength

Density

11 x 7

Fig. 6 is a longitudinal sectional view showing a stabproof panel 60 of the present invention. The stabproof panel 60 is constructed by spreading resinous bonding agent 61 on one surface of an aromatic polyamide woven fabric 41, high density polyethylene woven fabric or similar high strength woven fabric and, thereafter, projecting sands 62, each of which has a particle size corresponding to the particle size of a No. 100 to 500 sand paper, to the resinous bonding agent 61 to densely bond sands 62 on the surface.

10 The stabproof panel 60 is composed of 60 to 65 wt % of the aromatic polyamide woven fabric 41, a high density polyethylene woven fabric or a similar high strength woven fabric, 1 to 2 wt % of the resinous bonding agent 61 and 35 to 40 wt % of the sands. The physical characteristics of the 15 stabproof panel 60 tested by FITI Testing & Research Institute, or a test organization certified by the Korean government, are shown in table 4.

TABLE 4

Test items (Korean standards)	Test results	Remarks
Composition (KS K 0210)	100% aromatic polyamide fiber	-test method: quantitative composition, FTIR method -only woven fabric tested except for resin

Resin discrimination (KS K0210)	inorganic material, synthetic rubber, acrylic resin	test method; FTIR method
Ash (KS K0215)	38.7%	
Density (KS K0511)	warp: 55.2 weft: 50.2	standard: ply/5 cm
Weight (KS K0511)	423.4 g/m <sup>2</sup>	
Tensile strength (KS K0520)	warp: 474.6 weft: 317.9	test method: C.R.E. strip method standard: kgf/2.5 cm

Fig. 7 is a view showing the deformation of a plurality of tightly overlapped stabproof panels 60 when a blade pierces the stabproof panels. When a blade "B" reaches the stabproof panels 60, impact energy generated by the piercing of the 5 blade "B" is immediately transmitted to the stabproof panels 60. In particular, while enormous pushing power generated by concentrated load at the point of the blade "B" is transmitted to the stabproof panels 60, the power is weakened by the stabproof panels 60. As the pushing power is weakened by the 10 stabproof panels 60, the point of the blade "B" is blunted by the stabproof panels 60 in the rear panels of the stabproof panels 60. The stabproof function of the stabproof panels 60 against the blade "B" is similar to the bulletproof function of the bulletproof panel 40 against a bullet.

15 The stabproof and bulletproof panel 100 of the present invention, as illustrated in Fig. 8, is constructed by bringing five to twelve stabproof panels into tight contact with one another and positioning the bulletproof panel 40 in

back of the stabproof panels 60. Although not shown, the stabproof and bulletproof panel 100 is enclosed in a covering envelope. As shown in Fig. 9, the stabproof and bulletproof panel 100 is utilized while the covering envelope containing 5 the stabproof and bulletproof panel 100 is inserted into the panel holding portion of the garment of a stabproof and bulletproof jacket.

As a result of performance tests performed by H.P. White Laboratory Inc. in accordance with an internationally 10 certified test standard (NIJ STANDARD-0115.00) for testing bulletproof jackets established by the National Institute of Justice (NIJ), U.S. Department of Justice, the stabproof and bulletproof panel 100 of the present invention fulfilled the NIJ standard (see Report Nos. 8245-03A, 8245-03B and 8245-03C 15 of H.P. White Laboratory Inc.).

As described above, the present invention provides a bulletproof and stabproof panel, which has a superior feeling of comfort on wearing and is both bulletproof and stabproof.

Although the preferred embodiments of the present 20 invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.